

National Aeronautics and Space Administration

# Validation of MLS upper tropospheric carbon monoxide

Nathaniel Livesey + MLS Team

Jet Propulsion Laboratory, California Institute of Technology

TES, DACOM, ALIAS and ARGUS Teams

Aura Science and Validation Team Meeting

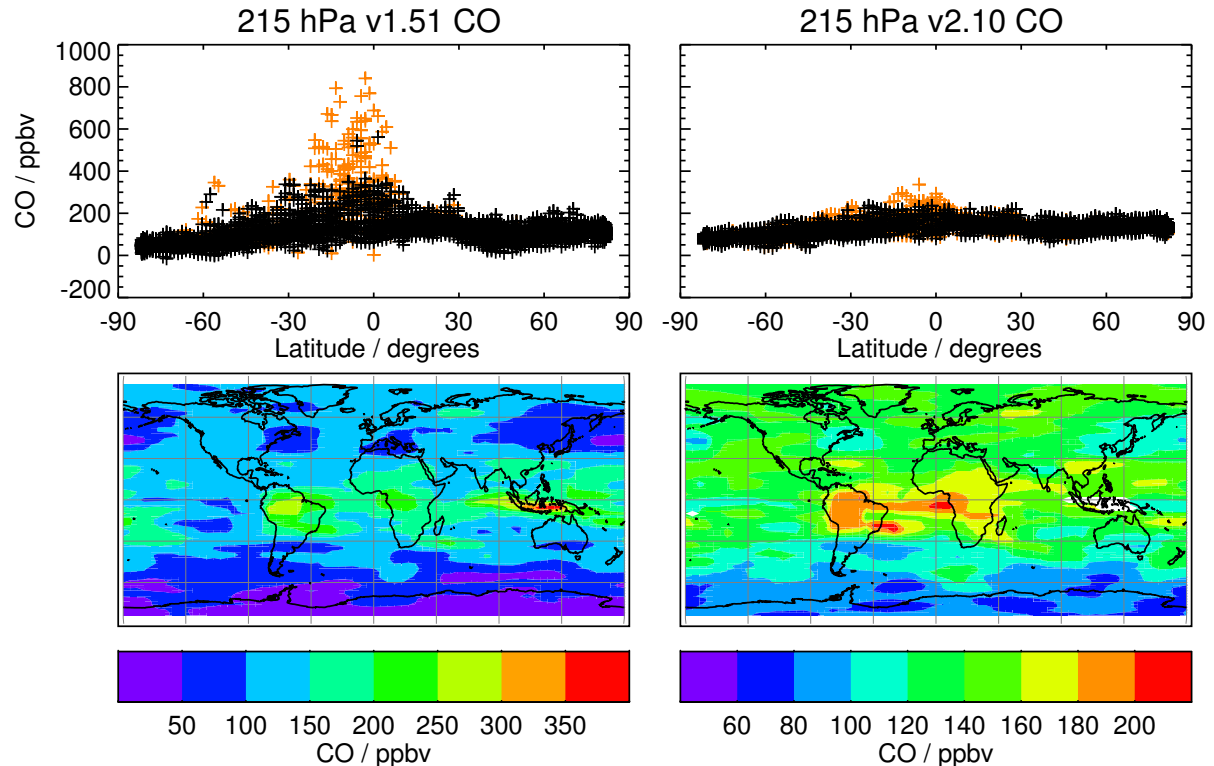
11–15 September 2006

Boulder CO

# Introduction, v2.1 vs. v1.5I MLS UT CO

- ❑ The version 2.1 CO shows significant improvement over the earlier v1.5 data

- ❑ V1.5 CO had significant spikes, usually associated with potential cloud contamination



- ❑ While the recommended filtering removed much of these, a residual level of ‘fuzz’ remained, particularly at 215 Pa (the lowest recommended level)
- ❑ V2.1 handles continuum signals, such as cloud signatures, in a different manner
- ❑ This has significantly reduced both the cloud spikes and the residual ‘fuzz’
- ❑ In turn, this has reduced the high bias seen in v1.5 at 215 hPa

# Approach to in-situ comparisons

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- ❑ The MLS data give a piecewise-linear representation of the atmospheric fields
  - ⇒ Profiles  $\sim 165$  km apart around the orbit on a 6/decade pressure grid
  - ⇒ Vertical resolution of information is  $\sim 4$  km with 30–50 ppbv precision on individual profiles
- ❑ To get an MLS estimate for an in-situ location, simply interpolate MLS data
  - ⇒ linearly in  $-\log$  pressure
  - ⇒ linearly in horizontal distance along the orbit (doing it in latitude is good enough in most cases)
- ❑ Computing the profile MLS should report given other, higher resolution, observations is more complex
  - ⇒ First a least squares fit of the correlative data to the MLS grid is needed
  - ⇒ Depending on the circumstances, the averaging kernel can also be applied
- ❑ For this talk, I'll be concentrating on the first set of comparisons

# MLS and DACOM curtain plot from INTEx-B

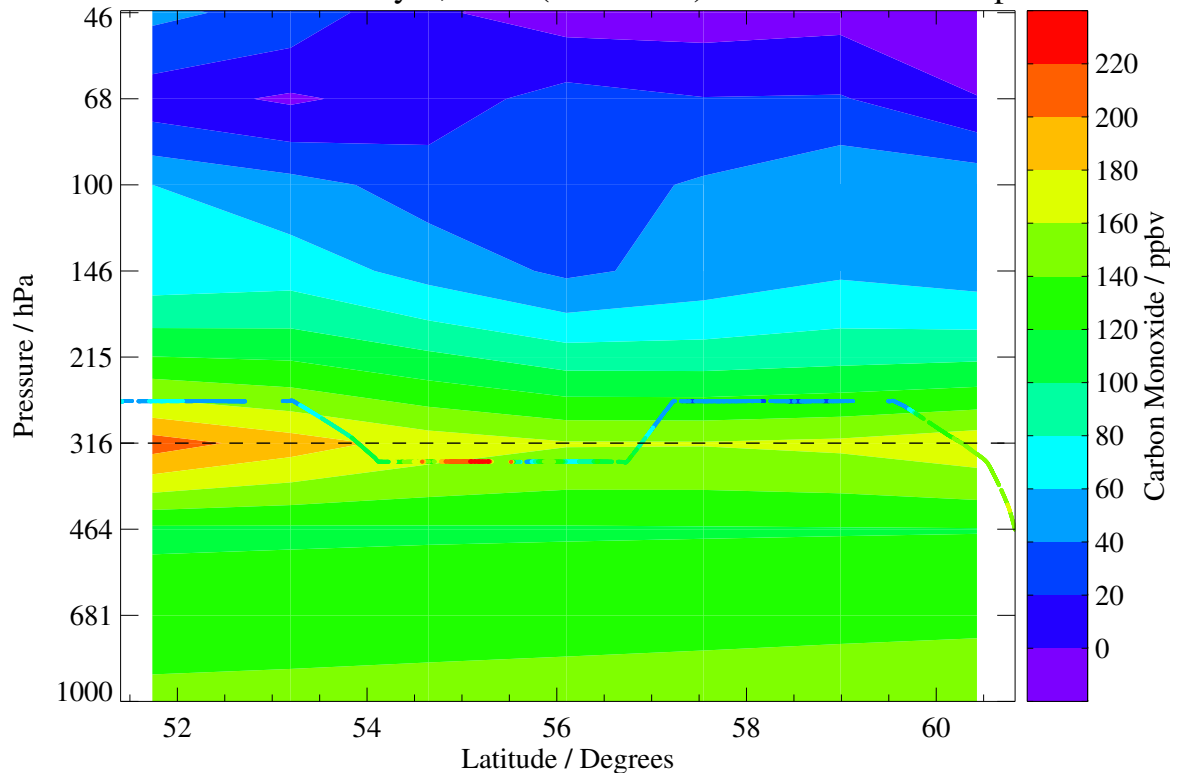
- Plot compares MLS and DACOM CO for 7th May 2006 INTEx-B flight

- MLS curtain shown in contour plot

- Overlaid colored dots are DACOM data

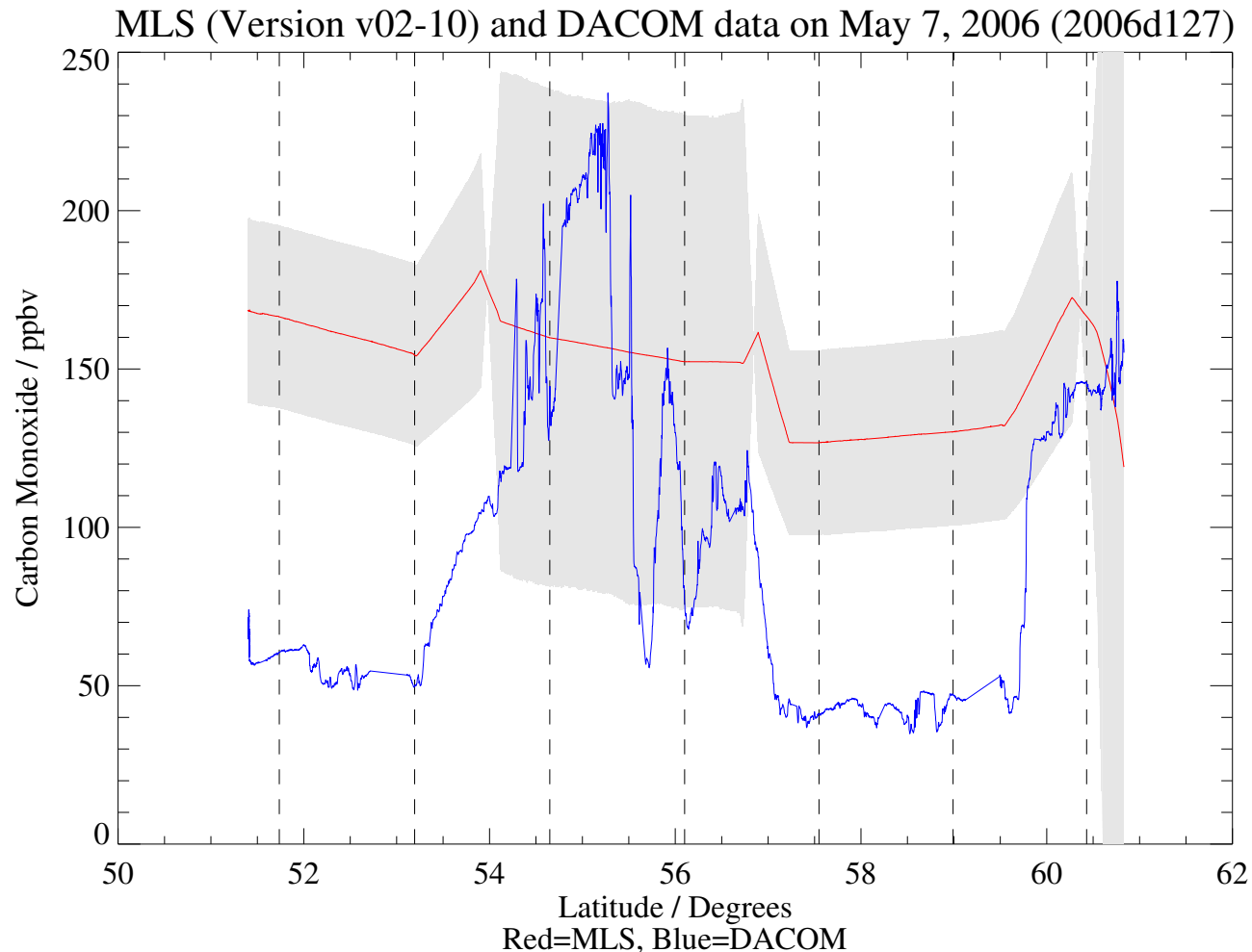
- MLS and DACOM in broad agreement on vertical structure

MLS v02-10 data for May 7, 2006 (2006d127) with DACOM overplotted.



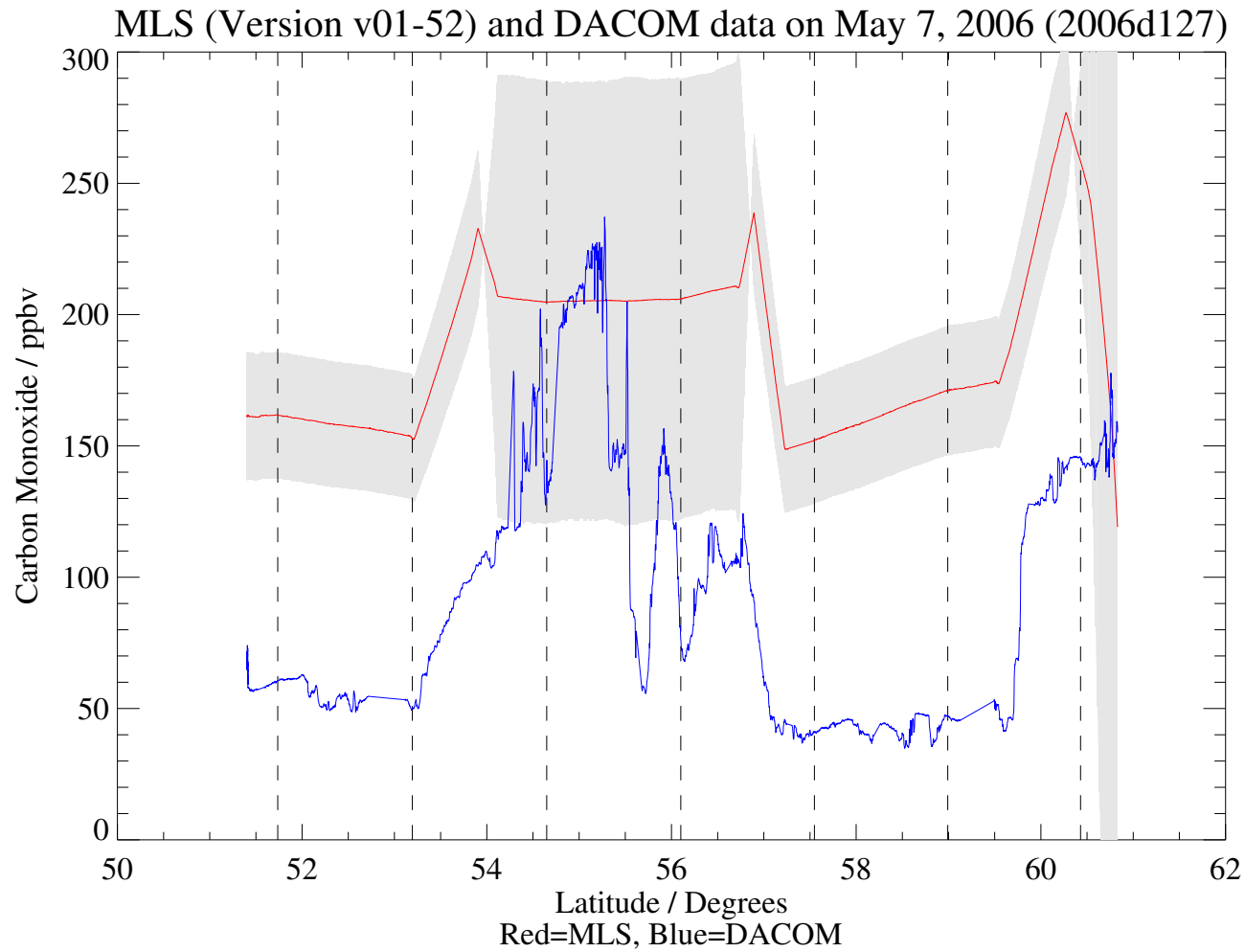
- However, MLS v2.1 clearly has a high bias at the low altitudes covered here
- Recall that the 316 hPa data were not recommended for scientific use in v1.5.1
- INTEx-B data will be helpful in assessing the utility of these data in v2.2

# Same comparison as a timeseries



- ❑ Here we show DACOM data and interpolated MLS together
- ❑ While the high bias is evident there is some agreement on morphology (mainly reflecting vertical gradients and altitude changes)

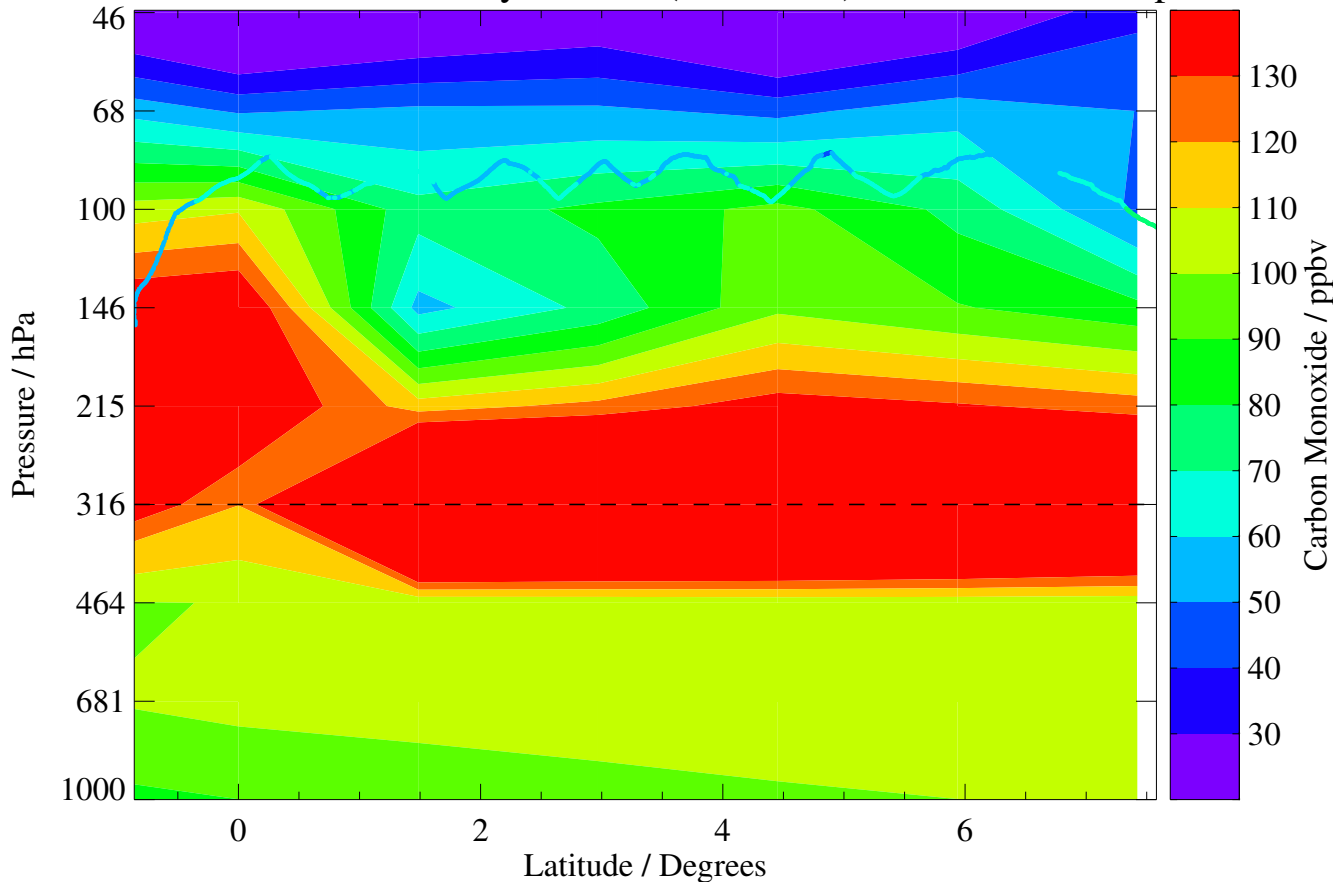
# Same comparison for v1.5 I



- ❑ This is the same comparison for the older version 1.5 data (different y-scale)
- ❑ The high bias at lower altitudes is more pronounced

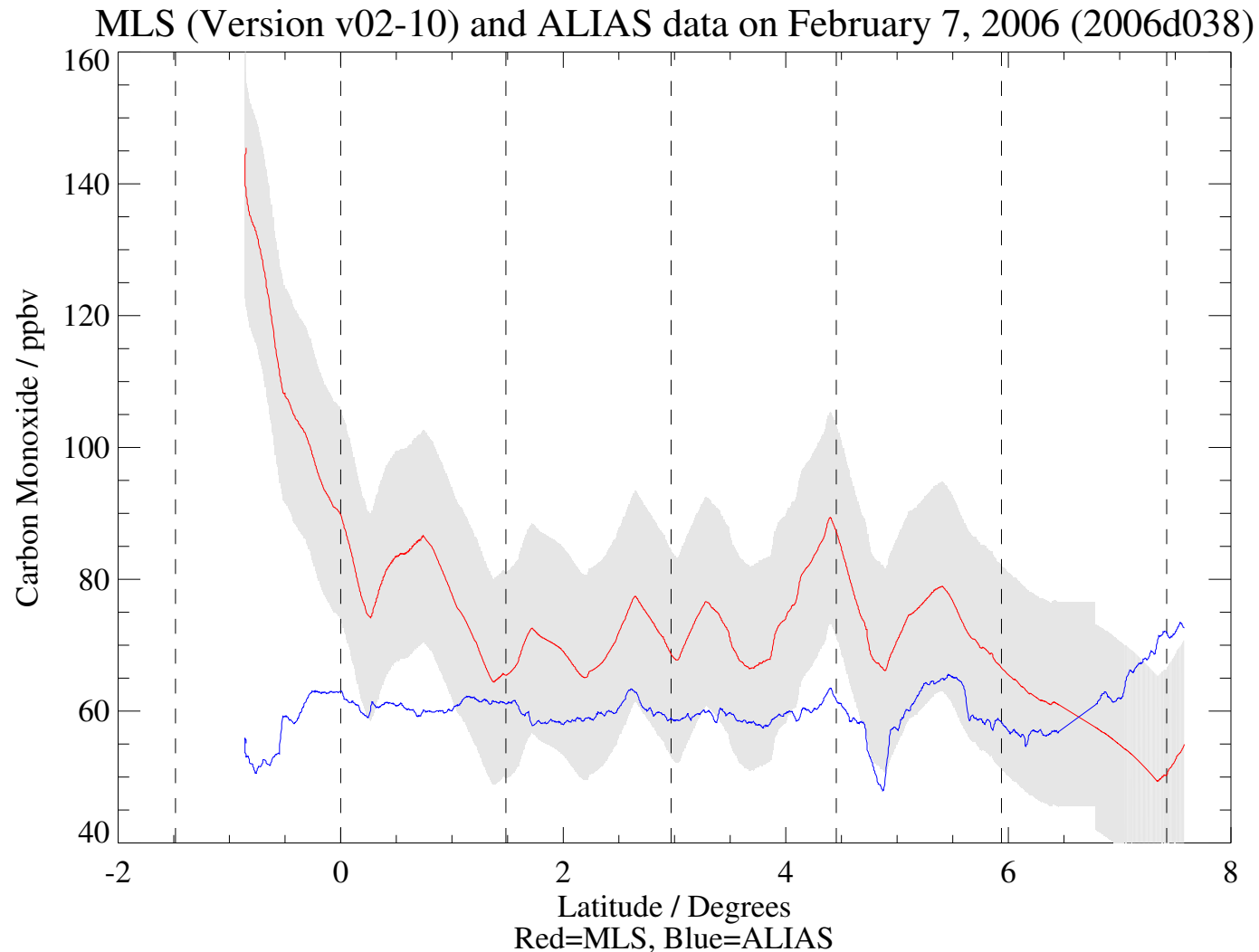
# MLS and ALIAS for CR-AVE (curtain)

MLS v02-10 data for February 7, 2006 (2006d038) with ALIAS overplotted.



- ☐ This curtain shows MLS and VWB-57 ALIAS for CR-AVE on 7 February 2006
- ☐ The MLS profiles were all flagged as having been affected by clouds
- ☐ This may account for the significant disagreement at the start of the flight

# MLS and ALIAS for CR-AVE (time series)

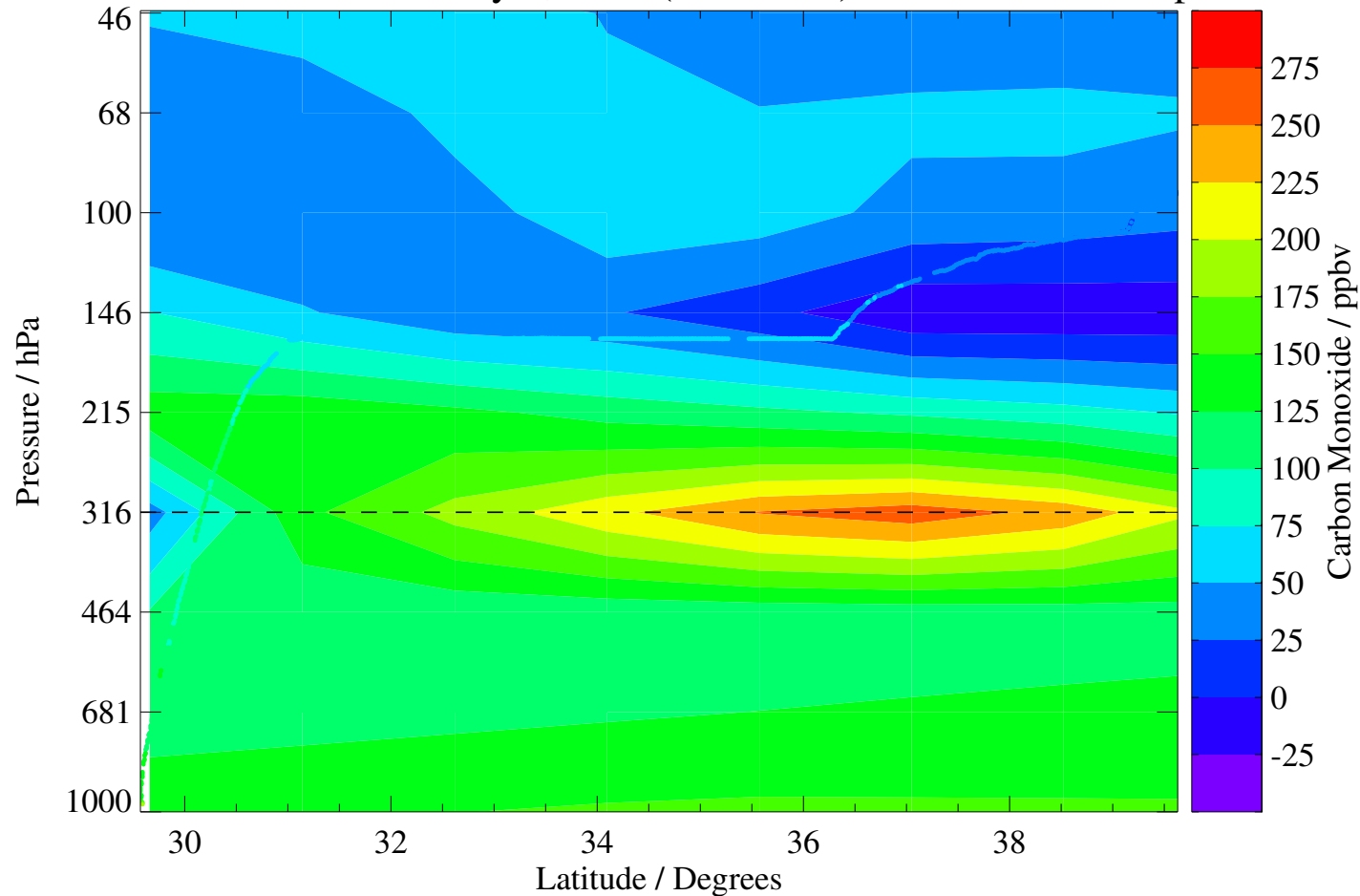


- ☐ Improving retrievals in clouds is a goal for future MLS versions
- ☐ Data from flights such as these will help here



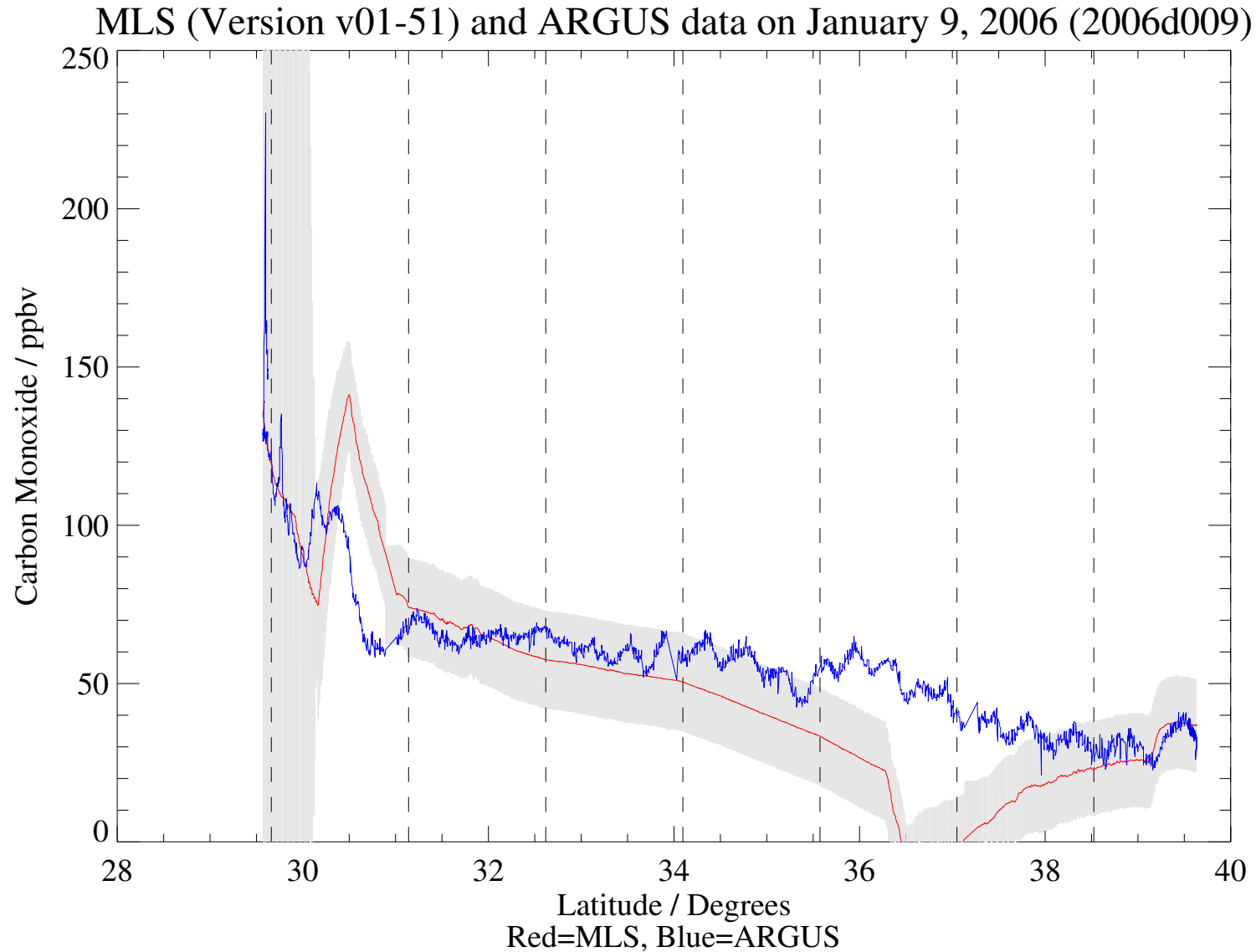
## VI.5 MLS and ARGUS for CR-AVE

MLS v01-51 data for January 9, 2006 (2006d009) with ARGUS overplotted.



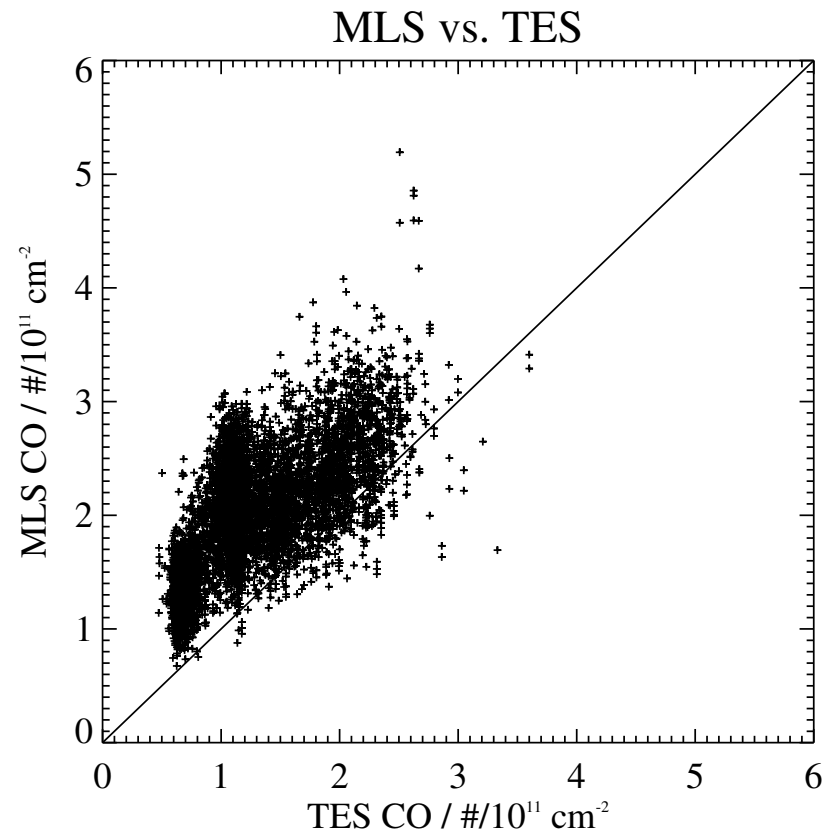
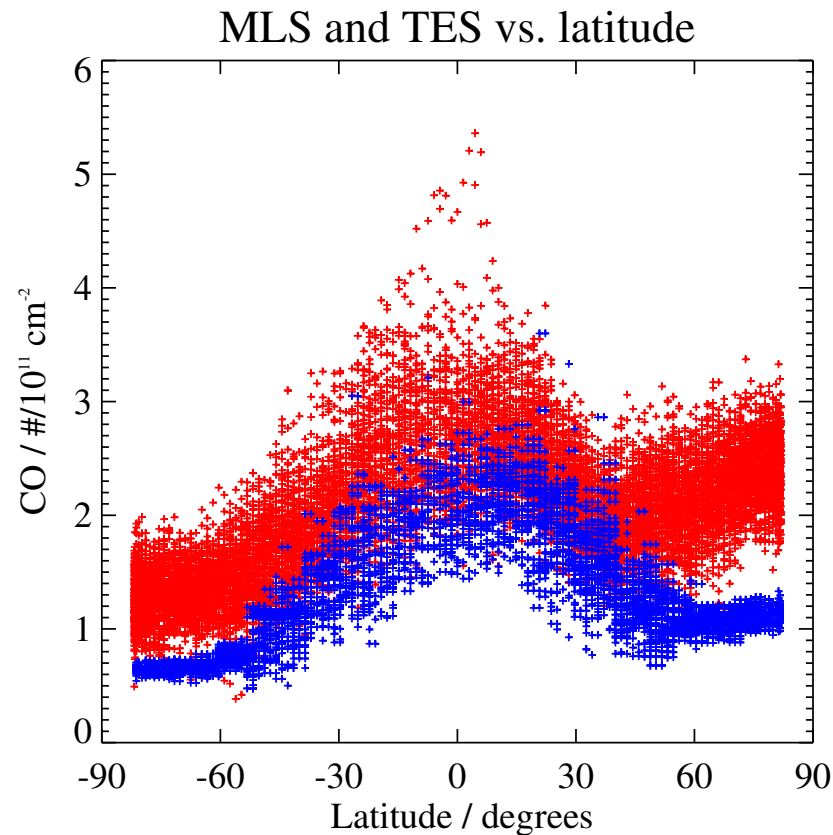
- ❑ This plot shows VWB-57 ARGUS data for CR-AVE on 9 January 2006
- ❑ MLS V2.1 not available for this day, so this is v1.5

## VI.5 MLS and ARGUS for CR-AVE



□ The level of agreement is very encouraging, particularly for v1.5

# Some preliminary TES comparisons



- ❑ Plot compares MLS (red) and TES (blue) column CO from 215–100 hPa
- ❑ MLS seems to be biased high compared to TES
- ❑ MLS simulations show a similar but smaller bias for this column quantity

# **Summary and plans for the CO validation paper**

- ❑ While v2.1 CO are better than v1.5 some high bias remains at lower altitudes
- ❑ The MLS CO product is reliable (bias aside) for 215 hPa and lesser pressures
- ❑ The quality of the 316 hPa data needs further investigation
- ❑ Version 2.2 are likely to be very similar to v2.1
  
- ❑ Additional issues to be covered in the validation paper include:
  - ❑ Full quantification of the various sources of systematic error
  - ❑ More comparisons with satellite datasets
    - ⇒ TES (as shown), AIRS, MOPITT, ACE/FTS(?), ODIN/SMR(?)
    - ⇒ Will in most cases just compare partial columns
    - ⇒ However, we still need to consider averaging kernel and precision issues
- ❑ Distillation of in-situ comparisons shown above into summary statistics
- ❑ Summary and prioritization of issues to be resolved in later MLS versions